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SF/AR

POTENTIAL FUTURE USES

FOR THE

MIDWAY LANDFILL SITE

CITY OF SEATTLE
DECEMBER, 1992

City of Seattle

Seattle Public Utilities
Dexter Horton Building,
10th floor 710 Second Avenue,
Seattle WA 98104
Solid Waste Field Operations

Letter of Transmittal

TO: MS. JUDI SCHWARZ ENVIRONMENTAL PROTECTION AGCY 1200 6TH AVE M.C. ECL 117 SEATTLE, WA. 98101	DATE 6/30/2000 JOB NO. RE: FUTURE USES FOR MIDWAY LANDFILL
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POTENTIAL FUTURE USES FOR THE MIDWAY LANDFILL SITE

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Planting Methods and Recommendations;
Osborn Pacific Group Inc.

POTENTIAL FUTURE USES FOR THE MIDWAY LANDFILL SITE

PURPOSE

The purpose of this report is to lay a foundation for developing a plan for the future use of the site containing the Midway Landfill. The residents in the Midway area expressed a strong interest in having a voice in the selection of the final site use. As a result, this report contains input from involved citizens who live in the neighborhoods surrounding the landfill.

It should be noted that the landfill site will not be ready for productive use for several years from the issuance of this report. The City of Seattle has completed closure work; monitoring and maintenance activities will likely continue for 20 years. However, no additional remedial actions beyond those already completed are planned at this time.

The decision-making process for determining how to choose a final use is not firmly established. The needs and wants in the Midway area may change over time. This report was prepared to provide a starting point for a decision-making process that will happen sometime in the future. There is no final recommendation made in the report, but it is rather a set of concepts and evaluation criteria that can be utilized in the future when the site can be put to productive use.

The report contains a chapter on the process used to generate the information in the report, a brief history of Midway Landfill, the constraints closure work already planned imposes on future uses, a list and evaluation of future uses, landscaping criteria, and citizen comments. The Citizens' Advisory Committee and the Seattle Solid Waste Utility hope that this report will make the selection of a final site use or uses an easier task in the future.

PROCESS

In July of 1989, the City of Seattle (Seattle) and the Washington State Department of Ecology (Ecology) involved the Midway community in a preliminary effort to develop ideas for future uses of the property containing the Midway Landfill. This decision resulted from interest expressed by the community to Ecology that residents living around the closed landfill have a voice in determining the ultimate use of the site.

Seattle decided that the best approach was to enlist a committee of interested residents who could represent themselves and their neighbors in expressing what uses they would prefer. In the Landfill Newsletter, a publication Seattle distributes to residents in the Midway area to keep them informed about landfill related issues, Seattle asked for volunteers to serve on the committee, and received responses from ten people who were either residents or had business interests in the area. The volunteers were from locations on all sides of the landfill, and provided good representation of the area. Also on the committee was a representative of the City of Kent. The committee was staffed by City of Seattle personnel who were working on the Midway Landfill closure project. The staff scheduled, organized, and ran the meetings, minutes of which are available in the files of the Landfill Section of the Solid Waste Utility.

The committee, named the Midway Citizens Advisory Committee, met seven times between August, 1989 and February, 1990. During the meetings, the committee generated a list of possible site uses ranked according to preference. The committee provided guidance on the format and content of this report.

HISTORY

From 1945 to 1966, the site of the current Midway Landfill was operated as a gravel pit. The site covers about 60 acres and lies about seventeen miles south of Seattle between State Route 99 to the west and Interstate 5 to the east (Fig. 1). In 1966, the City of Seattle leased the site and began using it as a landfill for nonputrescible waste. In 1960s solid waste terminology, "nonputrescible" was differentiated from "putrescible" waste mainly by its rate of decomposition. The category of putrescible waste included rapidly decomposing food scraps, such as household and restaurant garbage. The category of nonputrescible waste included organic materials that decompose slowly, such as demolition debris and wood wastes. Liquid industrial waste was also disposed of in the site. Records indicate that approximately two million gallons were disposed of during the 1970s, but from 1980 to 1983, Seattle records indicate that low levels of some industrial wastes also were deposited at the site but only after they had passed a state-mandated screening process administered by the Seattle-King County Health Department.

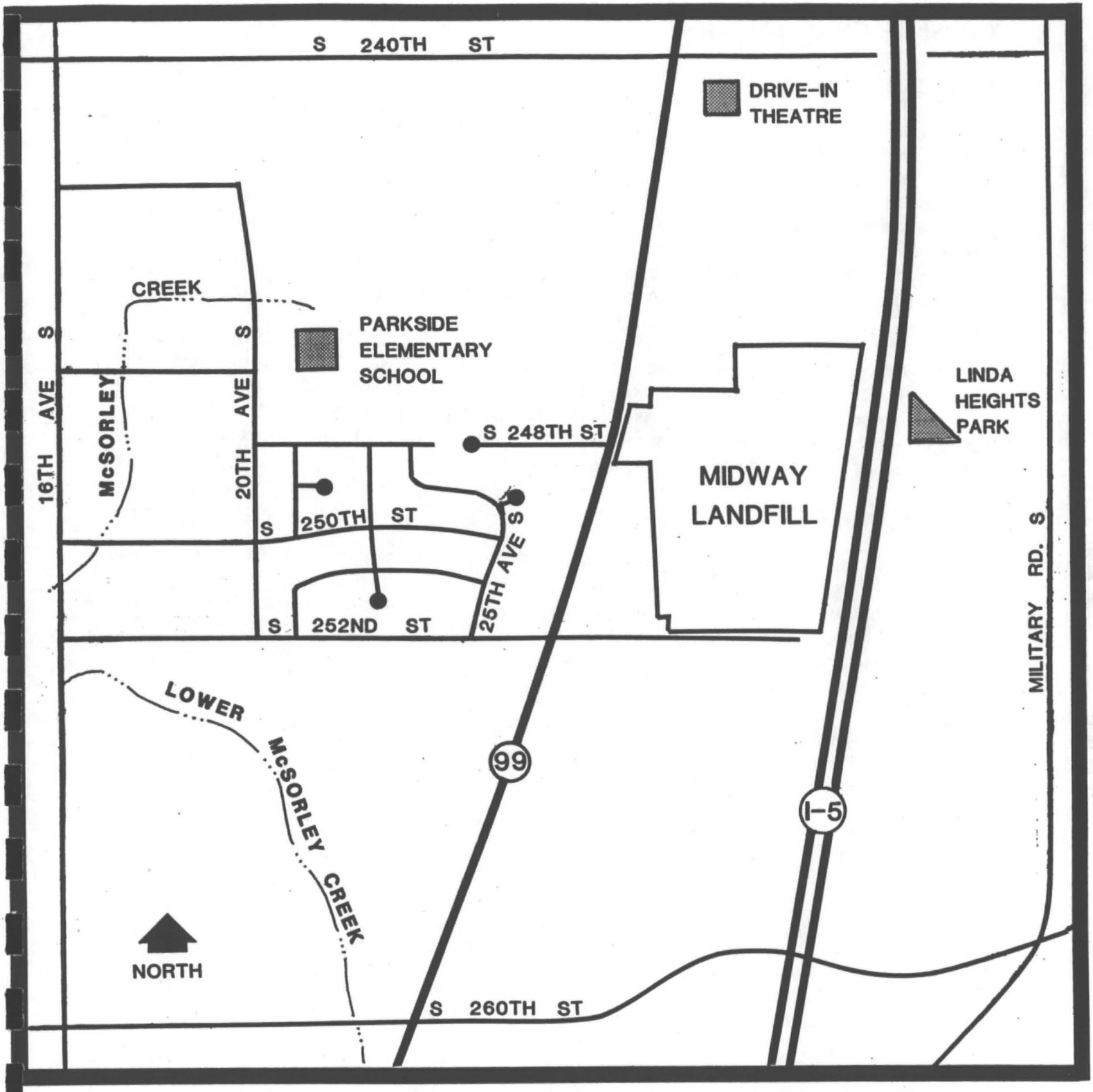
When Seattle closed the landfill in the fall of 1983, it began extensive testing of gas and water in the landfill and its vicinity. Samples of leachate and groundwater from monitoring wells in and around the landfill and gas samples from on-site and off-site gas probes indicated the presence of organic and inorganic contaminants with a potential for off-site migration. Subsequently, the State Department of Ecology also began investigating the site. Seattle hired a consultant to do a Closure Plan/Environmental Impact Statement which formulated actions necessary to close the landfill.

In September 1985, Seattle initiated remedial measures to control the off-site subsurface migration of gas and to prevent possible gas emissions from the landfill surface. Gas extraction wells were installed off-site, and gas migration control wells were installed on the perimeter and interior of the landfill. The objective of Seattle's active gas migration control system was to permanently prevent off-site migration of the landfill gas and to draw previously migrated landfill gas back to the landfill. To control surface emissions, the site was covered with 6-24 inches of silty sand material. Clean soil materials from excavation projects were accepted at the site to assist in this grading and cover. Seattle purchased the site in 1986.

For a more complete history of the site, please consult either the Midway Remedial Investigation Summary Report or both the Air/Gas Feasibility Study and the Groundwater Feasibility Study.

SUPERFUND STUDIES

In May 1986, the Environmental Protection Agency placed the site on its National Priority List (NPL) for cleanup. In August 1986, Seattle began a remedial investigation (RI) to determine the nature and extent of contamination in the area around the site due to the landfill. The RI was completed in summer 1988, and the results of the investigation can be found in a series of technical reports published at that time, or summarized in the Midway RI Summary Report. Seattle used this information to conduct a feasibility study (FS), to evaluate different alternatives to address problems found during the RI. Reports documenting the findings of the FS were published in December, 1990. The remedial actions formulated in the FS include many of the actions described in the Closure Plan, published in 1987.



MIDWAY LANDFILL VICINITY MAP

Figure 1 Midway Landfill Vicinity

CLOSURE CONSTRUCTION

Gas Control

By the end of 1990, Seattle had constructed most of the gas control elements described in the Closure Plan and evaluated in the FS. These included a permanent gas control system, with about 160 on-site perimeter and in-refuse gas control wells and a flare facility, located on the northwest part of the site, that contains three motor blowers and four shielded flares. (Two of the flares proved to be unnecessary and will be relocated and used at the Kent Highlands site.) The wells are connected by horizontal, above-ground manifolds that carry the extracted gas from the wells to the flares. There is also a system of condensate collection pipes located primarily in the upper 18 inches of the final cover. This system collects moisture from the gas extraction piping and carries it to a sewer force main near the permanent flare facility.

Off-site, over 140 gas monitoring probes were put in to measure the concentrations of gas around the landfill. Between 1986 and 1988, another nineteen off-site gas extraction wells were installed in the community. The purpose of these wells was to expedite the removal of subsurface landfill gas that had migrated outside the landfill boundary. As of mid-1991, only 2 gas extraction wells were still being used due to the significant decreases in off-site gas concentrations. Sixty-two of the off-site gas probes are still being monitored to assure that the on-site gas extraction system is working properly.

Surface Water and Leachate Control

Leachate is formed when water comes into contact with solid waste and picks up contaminants. Water can contact refuse in a landfill in several ways. The most common is infiltration from precipitation. Surface water run-on can also infiltrate the refuse, and groundwater can contact refuse through underground flow. If there is no leachate control, the leachate can enter a groundwater system and contaminate aquifers. This has happened at the Midway Landfill, and much of the remedial construction at the landfill has been done to keep more leachate from forming.

There are three principal sources of water that can result in the formation of leachate at the landfill: infiltration from precipitation, inflow from a pipe that drains the Linda Heights drainage system to the east of the landfill, and shallow groundwater inflow at the north and south borders of the landfill.

To stop these sources of water from contacting the buried waste, several measures were taken. The landfill was graded so that surface water would not pond up on the site and instead drain to a detention pond north of the site. A very low permeability cover system was placed over the landfill so that surface water would not penetrate the landfill surface. The cover consists of several layers (from bottom to top): 1 foot thick layer of clay or bentonite-amended soil (permeability not greater than $1x10^{-7}$cm/sec), a layer of 50 mil high density polyethylene (HDPE) flexible membrane liner (FML), plastic drainage net, synthetic filter fabric, 1 foot thick sand drainage layer, and a 1 foot thick layer of topsoil planted with shallow-rooted grasses (Fig. 2). A system of drainage pipes intercepts the water in the drainage layer. The drainage lines are surrounded by gravel and lie between the HDPE liner and the sand layer.

The storm water runoff from the landfill surface goes into a lined, ten million gallon detention pond located north of the landfill. The HDPE liner under the pond ensures that water from the pond will not contact buried waste. The water collected in the detention pond is released through a flow control structure into a pipeline that carries it to the North Fork of McSorley Creek located southwest of the landfill. Historically, the surface water runoff from I-5 and the Linda Heights neighborhood east of the landfill discharged into the landfill, creating additional leachate. A diversion system has been constructed east of the site which now redirects the surface water runoff into the detention pond.

FINAL LANDFILL COVER DESIGN

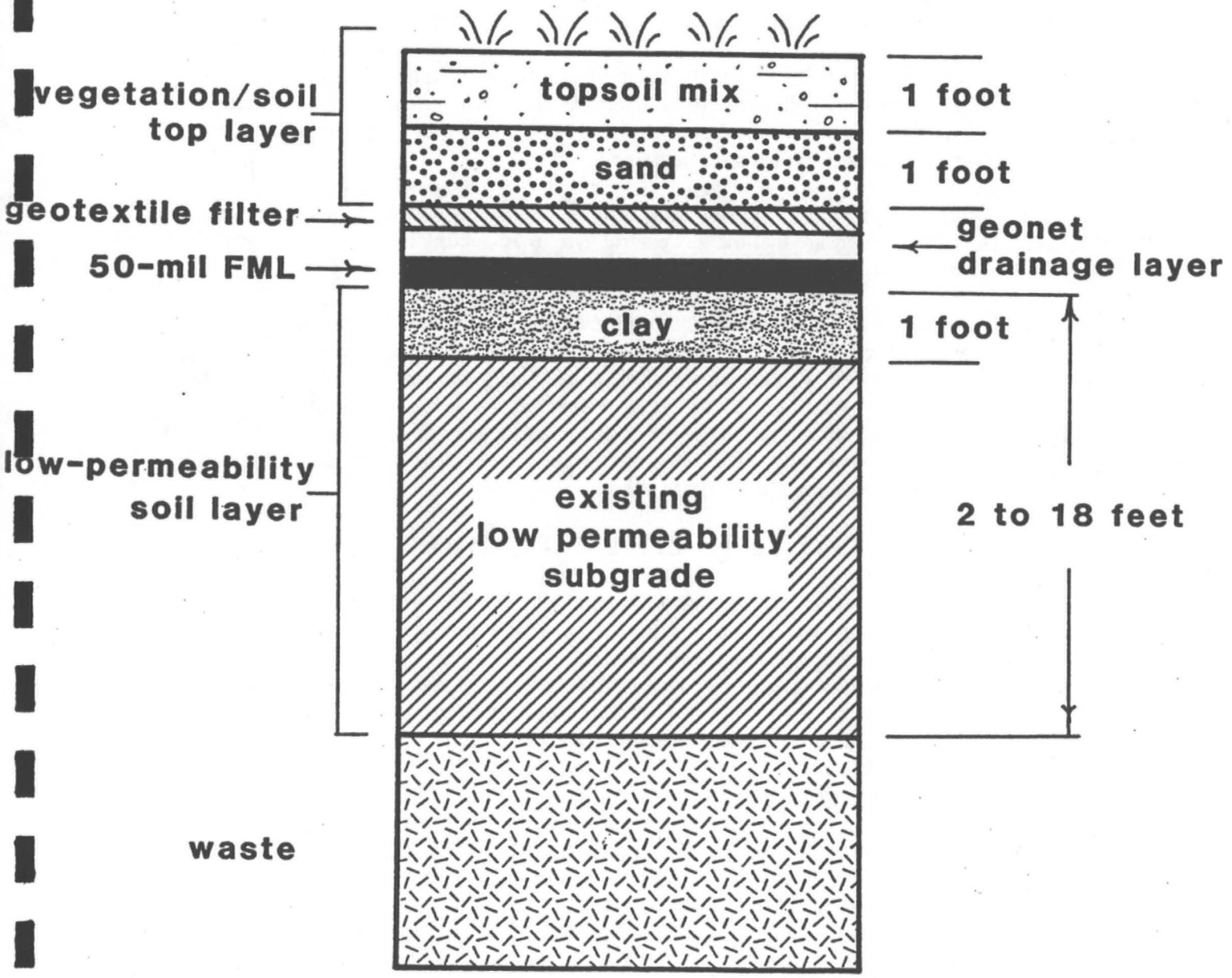


Figure 2. Final Cover Layers

NOT TO SCALE

Potential Future Remedial Actions

The Midway Landfill Feasibility Study, completed in December, 1990, presents an analysis of cleanup alternatives for the landfill, and selects a preferred alternative. The preferred alternative for the Midway Landfill comprises the remedial actions already taken by the City of Seattle as described above and continued monitoring to ensure proper performance is maintained.

After receiving public comment, Seattle and Ecology will negotiate a final Cleanup Action Plan (CAP), which will determine the actual final remedial actions. Although it is expected that the actions taken to date will be sufficient, it is possible that additional measures will be needed. This will be determined by long-term monitoring of the performance of the actions already taken. If any additional measures do need to be undertaken, they may add to the constraints imposed on future use of the site.

Seattle plans to monitor both groundwater quality and leachate quantity on a quarterly basis over the next several years. This information will be used to determine if off-site groundwater contamination is diminishing as anticipated. Other measures described in the Feasibility Study may need to be undertaken if the contamination does not drop below specified levels.

Gas monitoring will also continue for 20 years or as long as determined necessary by the Seattle King-County Health Department to ensure that the gas control system is meeting its performance goals. The schedule for probe monitoring will be part of the final Cleanup Action Plan.

It is also possible that Ecology could require additional remedial action after issuance of the CAP. Under RCW 70.105D.050(4) Ecology may order further actions if factors not known at the time of the CAP are discovered and present a previously unknown threat to human health and the environment. Ecology is also required under regulation WAC 173-340-4230, to review the site at least every five years. Again, while it is unlikely that any further action will be required, evaluating potential future uses of the site will require consideration of this possibility. The Consent Decree between Seattle and Ecology also makes stipulations concerning future property transfers or sales.

SITE USE LIMITATIONS DUE TO REMEDIAL ACTIONS

Any future use of the landfill site must be evaluated according to how compatible it is with the remedial actions that are in place. The remedial actions that have been taken will be maintained and monitored for 20 years or as long as determined necessary by the Seattle-King County Health Department. It is anticipated that the landfill will continue to produce methane for that period of time, and it is important that water be kept away from the refuse so that leachate generation does not continue. Therefore, any future use of the site must be compatible with cleanup measures.

Constraints from the Final Cover

The cover on the landfill prevents surface water from contacting the refuse underneath it. The two most critical layers in stopping the water are the HDPE liner and the foot of clay underlying the liner. There are two feet of sand and topsoil above the liner, and any penetration deeper than this depth could compromise the integrity of the liner. Any sort of deep foundation, deep-rooted plants, poles or posts sunk deeper than (or even approaching) two feet would not be allowed. Special design considerations would have to be developed for a potential future site use to ensure that the liner is not disturbed.

Constraints from Gas System

There are many wells on the site drawing gas from the refuse in the landfill. These wells are connected by above-ground horizontal piping called gas manifolds (Fig. 3). As shown in the figure, the manifolds form a maze over the surface of the site that leaves very little continuous open space. In addition, there are the buried condensate collection pipes and the buried drainage lines that cannot be disturbed. It is possible that, sometime in the future, some of the gas manifold can be buried to allow for a clear, more usable surface; however, it poses a severe constraint on use in the near future. The gas manifold cannot be buried until landfill settlement has decreased to the point where pipe maintenance is no longer a significant problem.

Constraints from Landfill Settlement

Under the final cover and the several feet of subgrade beneath the final cover lies approximately 3 million cubic yards of solid waste. The waste is heterogeneous, and interlayered with daily cover material from landfill operations. As the waste decomposes, it becomes subject to settlement. Different kinds of waste in the landfill decompose at different rates. There are voids in the landfill and areas where the waste is not as compact as in other areas. The landfill will dry out because of the remedial actions that have been taken. These factors lead to differential settlement, which has actually been taking place during the life of the landfill, and will continue to occur.

Because of settlement, the landfill forms an unstable base for any sort of permanent structure with a foundation. As time passes and the waste decomposes more, the settlement will slow down and become less of a factor. It will always affect, however, the kinds of structures that can be built on the landfill, and the maintenance of roads and parking lots that accompany the structures.

Operation and Maintenance Constraints

Seattle will have to maintain the gas control and leachate control systems as long as they are necessary at the landfill. Seattle's maintenance crews will require continued access to the landfill to perform maintenance tasks such as periodic adjustment of gas control wells and leachate wells, repair of the cover and inspection of all systems. As a consequence, maintenance crews will be a regular presence on the site regardless of its future use.

Other Constraints

If the site will be used for public activities, additional factors will have to be considered. Access from State Route 99 (Pacific Highway South) would have to be developed. The community is quite adamant that they do not want any access to the site developed from S. 252nd Street. Areas would have to be set aside for parking. Utilities for restrooms on the site would have to be developed, meaning possible underground construction which could interfere with the liner. Security of the on-site closure systems would also have to be dealt with. There are other constraints that are specific to individual uses, and they will be mentioned when the potential site uses are discussed later in this report. Of course, any future site use would also have to comply with all federal and state health and safety regulations.

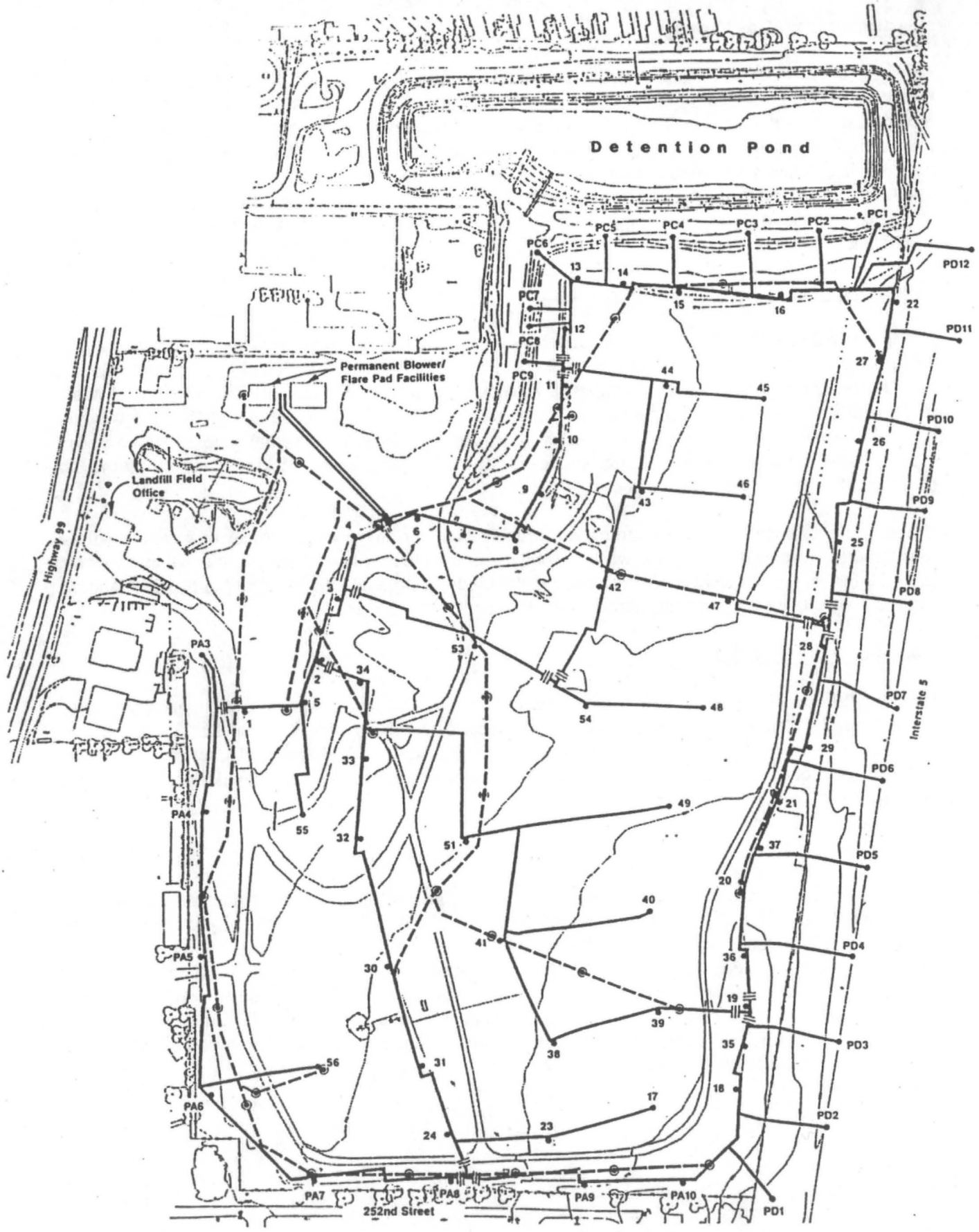


Figure 3. Gas Manifold System

DEVELOPMENT AND EVALUATION OF FUTURE USES BY THE COMMUNITY

The principal reason for convening the Midway Citizens Advisory Committee (MCAC) was to gain input from residents living near the landfill concerning their future vision for the closed landfill site. The residents around the landfill have a history of being involved in landfill-related issues and have organized into groups in response to the landfill. Seattle wanted to get a sense of what the Midway community preferred the site to be used for once closure had reached the point when uses could be considered. The MCAC served as Seattle's link to the greater Midway community.

Over the course of several meetings the MCAC developed a list of preferred uses for the site. This was done after they had been apprised of the limitations that would be encountered because of closure activities and the fact that implementation of any of the potential uses could happen only after a suitable time span had elapsed, perhaps five to ten years. The MCAC also realized that there were no guarantees that a particular use would be chosen, but that the report is to be a starting point in considering future uses when the site is ready. Since the site covers approximately sixty acres, it is possible that there may be more than one use chosen for the site.

Before developing their list, the MCAC received information from the City of Kent about the zoning of the site. Fred Satterstrom from the Kent Planning Department told the MCAC that the property was zoned GC (general commercial), so potential uses could comprise a large range of options. Presentations were also given by a youth soccer federation and the Seattle Model Yacht Club on how their needs would be met by the landfill property. Their needs seemed more immediate than Seattle could accommodate because of its closure work, but they were kept as concepts by the committee for consideration.

The following is a list of potential uses developed by the MCAC. They are ranked according to preference and divided into two categories: non-revenue producing and revenue producing. The highest ranking a particular use could attain was 60. The MCAC noted that some of the non-revenue producing ideas may, in fact, have the potential to produce revenue. For example, it may be possible to charge fees for use of the meeting facility, remote control area or day camp.

Non-Revenue Producing

Passive Park 59

Children's Playground 57

Picnic Area 56

Jogging Trail (perimeter) 56

Sports Complex 50**

Bird Habitat/Natural Area 46

Community Meeting Facility 44

Park With Limited Facilities 37

Day Camp Facility 33

Remote Control Area 20

**The Committee also rated a variety of sports activities that could be included in a sports complex or park with limited facilities:

Soccer Field(s)	58
Track	58
Basketball Court(s)	42
Baseball Field(s)	40
Tennis Courts	37
Bike Path(s)	37
Skateboard Track(s)	21

Revenue Producing

Garden Center	59
Composting Center	42
Community College Annex	40
Driving Range	35
Golf Course	24
Recycling Center	15
Park and Ride Lot	12
Trailer Court	3

ADDITIONAL CRITERIA FOR EVALUATING ALTERNATIVES

While the previous section rates potential site uses based on the preferences of the members of the Midway Citizens Advisory Committee, the following criteria consider a broader range of factors and would need to be considered in reviewing fuiture potential uses. These would include:

1. Compatibility with existing facilities:
   - gas extraction wells and manifolds
   - access roads
   - flare facility
   - stormwater system
   - piping
   - ditches
   - pond
   - final cover (preserve integrity)
   - monitoring and sampling

2. Settlement - loading due to proposed use

3. Operation and maintenance - on-going access for field crews

4. Slope of site - maintain drainage

5. Health and safety considerations:
   - certain areas off-limits
   - pond

6. Local zoning and code requirements:
   - available utilities
   - traffic

7. Neighborhood enhancement:
   - aesthetics
   - additional opportunities or activities available

8. Neighborhood compatibility

9. Cost and funding:
   - revenue generating
   - fund source

10. Operation and maintenance of use itself

11. Gas utilization

12. Population served

13. Community acceptance

EVALUATION OF SUGGESTED POTENTIAL FUTURE USES

The following section outlines a preliminary evaluation of the potential uses developed by the MCAC according to the criteria listed in the previous section. Where some of the uses were sufficiently similar, they were evaluated as a group. No final decision will be made that one use is preferred; the uses are reviewed to provide a starting point for decision-makers in the future. Additional review and evaluation of options will be necessary to support any final decision.

No matter what use the property is finally put to, it has a real estate value which is considered part of its cost. The construction of any amenities is an additional capital cost.

Passive Park, Children's Playground, Picnic Area, Park with Limited Facilities

These uses would consist of a limited area, perhaps five acres, with various facilities for sitting, walking, recreation, or eating. They would use an open space, planted with grass or other shallow-rooted vegetation. They would require access from State Route 99 and parking for users. Restrooms would also be a desirable amenity.

Evaluation

1) Compatibility with existing facilities: The manifolds from the gas extraction system would have to be either moved or buried on certain parts of the landfill site to create enough open space for the passive park/picnic area. The passive park use could be located so it did not interfere with the flare facility, stormwater collection system, and monitoring points. The passive park uses would not compromise the

final cover; the cover would limit the kind of vegetation that could be used in the park, however, unless additional soil was imported to create landscape planting areas.

2) Settlement: Settlement would not be a limiting factor in the construction and use of a passive park/picnic area.

3) Operation and maintenance of the site: The passive park/picnic area would probably not interfere with crews doing on-going O&M work. Additional and more costly maintenance may be created by having gas collection manifolds buried underground.

4) Slope of the site: Not a factor for a passive park/picnic area.

5) Health and safety concerns: The passive park/picnic area would need to be fenced to restrict users' access to other landfill facilities. The hours of operation of the park would determine the need for lighting, and the potential for vandalism.

6) Local zoning and code requirements: The area is zoned General Commercial, so zoning is compatible with siting a passive park/picnic area. The City of Kent would have to be included in the planning and permitting process. There would be a slight, but probably insignificant increase in traffic along Pacific Highway South by users of the park. Restrooms would have to located where settlement would be minimal, and special development of utility connections, such as importation of additional soil materials, would have to be done because of the impermeable cover.

7) Neighborhood enhancement: The park/picnic area would be visually appealing, and would probably not affect the views of many of the residents in the area. It would provide a quiet, open space that people could enjoy. Some residents living very near to the park/picnic area may find it a minor intrusion due to noise and public use.

8) Neighborhood compatibility: The park/picnic area should fit in well with the surrounding land uses.

9) Cost and funding: The park/picnic area would not generate revenue, and would require maintenance. This would require a defined source of funding.

10) Operation and maintenance: Maintenance of the park/picnic area would have to be provided, and would have an annual cost. Decisions about lighting, access, hours of operation and other matters would affect the cost of this category.

11) Landfill gas utilization: The park/picnic area would not use landfill gas for any foreseeable purpose.

12) Population served: The park/picnic area could be used by anyone from around the Midway area, and serves no special interests.

13) Community acceptance: These uses were rated among the highest by the Midway Citizens Advisory Committee.

Jogging Trail (perimeter)

This use would consist of a narrow band of land near the outside boundary of the site. By regulation, the site is presently fenced. Depending on the use of the remainder of the site, all or part of it would have to be fenced separate from the jogging trail. This could result in a narrow band of land around the outside

of the site that has very limited access. A jogging trail as an isolated use may not make as much sense as a jogging trail as part of a park or sports complex.

Evaluation

1) Compatibility with existing facilities: A major drawback to a perimeter jogging trail is the conflict it would have with the gas control system. Many of the gas control wells line the perimeter of the site, and horizontal manifolds connect these wells to flare facility located on the northwest part of the site. There is also a road that is used for operation and maintenance that travels around the border of the site. A jogging trail around the boundary of the site would conflict with these in-place facilities.

2) Settlement: Settlement would not be a limiting factor in the construction and use of a jogging trail.

3) Operation and maintenance of the site: The jogging trail could make maintenance more difficult because it would make access to the site harder. If the jogging trail is fenced, workers would have to get through the fence to get to the areas they were maintaining.

4) Slope of the site: Not a factor for a jogging trail. If anything, it enhances the trail by making it more interesting.

5) Health and safety concerns: Because of the fencing needed and the very limited access that results, joggers could be a long way from help and quite isolated at certain areas along the trail. The trail may have to be lit or have restricted hours for safety considerations.

6) Local zoning and code requirements: Compatible.

7) Neighborhood enhancement: Not a major factor. The jogging trail would do little to beautify the area, but would add a recreational use that could be enjoyed by some.

8) Neighborhood compatibility: A jogging trail would not be incompatible with the neighborhood.

9) Cost and funding: The jogging trail would not generate revenue and would require maintenance. This would require a defined source of funding. The cost of building the jogging trail would require an initial capital investment.

10) Operation and maintenance of the trail: This would have to be funded from some source. Decisions about lighting, access, hours of operation and other matters would also affect this category.

11) Landfill gas utilization: The trail would not use landfill gas for any foreseeable purpose.

12) Population served: The park could be used by anyone from around the Midway area, and appeals most strongly to those who are joggers or interested in fitness.

13) Community acceptance: This use was rated very high by the Midway Citizens Advisory Committee.

Sports Complex

This use would consist of either single or multiple facilities for sports. It could be as basic as a set of tennis courts or basketball courts, or could comprise several soccer and baseball fields. The extent to which this concept is developed affects how feasible its implementation would be.

Evaluation

1) Compatibility with existing facilities: The manifolds from the gas extraction systems would either have to be moved or buried over a certain part of the landfill to create enough open space for this use, depending on the extent of the use. There are wells in nearly every acre of the landfill, and these would have to be adapted so they would not protrude from the surface. To accommodate a use that required several acres, a great deal of adjustment would have to be done with existing systems. There could be no penetrations greater then one and a half feet through the existing soil layer so that the barrier layer of the cover would not be compromised.

2) Settlement: Settlement may affect the surface of smooth areas, such as those necessary for tennis and/or basketball courts, which would increase the need for maintenance of these facilities.

3) Operation and maintenance of the site: Burying the gas manifolds would make operation and maintenance of the gas control system more difficult. Crews may have to monitor wells that are in locked utility vaults on athletic fields. Drainage would have to be maintained so that on-site water still drained to the detention pond.

4) Slope of the site: This is not a major factor as long as drainage is maintained.

5) Health and safety concerns: The facility would have to be fenced to restrict users' access to other landfill facilities.

6) Local zoning and code requirements: Zoning is compatible with the siting of sports facilities. The City of Kent would have to be included in the planning and permitting process. There could be a noticeable increase in traffic at certain times along Pacific Highway South by users of the facility.

7) Neighborhood enhancement: The sports complex would be enjoyed by many people from the Midway area. It may have a negative impact on nearby residents because of increased traffic and noise.

8) Neighborhood compatibility: A sports complex would not be out-of-place in this area. Some nearby residents may not want the additional traffic and noise.

9) Cost and funding: The complex may or may not generate revenue, depending on how it is managed. The cost of building the complex could be considerable depending on its scale, and this would require an initial capital investment, including the cost of the property.

10) Operation and maintenance of the sports complex: Depending on who is in charge of the complex (or individual facility), maintenance would be required and would have an annual cost. Parking, restrooms, and lighting would be required to fit the scale of the use. These would also require maintenance.

11) Landfill gas utilization: This use would not use landfill gas for any foreseeable purpose.

12) Population served: The sports complex could be used by anyone from around the Midway area, and serves no special interests. If it is used for organized or spectator sports, it may draw from an even larger area.

13) Community acceptance: This use was highly favored by the Midway Citizens Advisory Committee. There was some disagreement about the particular sport(s) that should be chosen, but most members of the committee favored this use in general.

Bird Habitat/Natural Area

The evaluation for this use would be similar to that for a passive park. This particular use could require more area than the park. A certain area would have to be set aside for observation, and the remaining area would be used as the natural area. Because of the landfill cover, the vegetation on the area would be limited to shallow-rooted varieties (see section on landscaping). Consequently, the area may not be as visually interesting as many natural areas, or as attractive to as many species. A creative use of vegetation could help rectify this problem. This use was rated quite high by the Midway Citizens Advisory Committee.

Community Meeting Facility and Day Camp Facility

These uses would require some sort of structure. The permanence of the structure affects how feasible this is as a potential use. A temporary building that requires a minimal foundation could be placed on the site; however, any structure requiring a substantial foundation would be difficult or impossible to construct.

Evaluation

1) Compatibility with existing facilities: Since a building is involved, the foundation would have to be minimal so that the impermeable layers of the final cover remain undisturbed. The final cover has a two foot soil layer above the plastic barrier layer, and the foundation would have to stay within this zone or else additional soil would have to be brought in. Underground utilities would also be a concern because of the same restrictions. For a day camp, the site would be somewhat uninteresting because of the lack of vegetation. To make enough room for outdoor activities, some of the gas manifold system would have to be buried underground.

2) Settlement: Settlement could affect the structural integrity of a building placed on the landfill. Without the benefit of a substantial foundation, a building would be subject to the instability of the landfill. Even a trailer, depending on its size, could suffer damage due to settlement.

3) Operation and maintenance of the site: These uses should not keep crews from doing on-going O&M work. Additional and more costly maintenance may be created by having gas collection manifolds buried underground.

4) Slope of the site: Not a factor for these uses.

5) Health and safety concerns: Either facility would have to be fenced to restrict users' access to other landfill facilities.

6) Local zoning and code requirements: The zoning is compatible for either use.

7) Neighborhood enhancement: A community meeting facility would be an asset to the area in establishing a meeting place for residents and community organizations. A day camp would provide controlled activities for children and/or senior citizens in the area.

8) Neighborhood compatibility: Either use would fit in with the surrounding area.

9) Cost and funding: Both uses have the potential of generating revenue to pay for themselves. These uses would have initial capital costs including the cost of the property that would have to come from some source.

10) Operation and maintenance: O&M would have to be provided by the organization running the facility. The O&M cost could be paid for by a users' fee.

11) Landfill gas utilization: Neither use would utilize landfill gas for any foreseeable purpose.

12) Population served: These facilities would be used by interested people from the surrounding area. The need for them may need to be documented.

13) Community acceptance: These fared less well than most of the previously evaluated uses, though some of the committee members did see a need for them.

Remote Control Area

During the course of the Midway Citizens Advisory Committee meetings, a member of the Seattle Model Yacht Club attended and gave a presentation on the use of the Midway detention pond north of the landfill as a potential site for their remotely controlled boats. It turned out that the dimensions of the pond were not ideal, and the use was additionally marred by the fact that the detention pond would be empty most of the time, during the warmer seasons especially. (The pond is intended to control surface water discharge, not to be used as a holding pond.) It was further discussed that it would be highly impractical to locate a pond any place else on the site, so the idea of a remote control area for boats does not appear sound.

Other remote control uses are possible. Using part of the site for remote control cars or hovercraft seems possible because it would require no more adaptation than a park. Flying remote control airplanes seems an unlikely alternative because it is in the SeaTac flight path, not to mention that much of the site would remain inaccessible so that if there was a problem with the aircraft--such as its landing in a restricted area--it might be impossible to get to the model. The presence of two heavily travelled state routes on either side of the landfill also weighs against remote controlled model aircraft. This use was rated lowest of all non-revenue producing uses by the MCAC.

Garden Center

Using the site as a garden center would entail using the site as a commercial distribution point for plants, complete with greenhouses and light duty buildings. The limited access from Pacific Highway South would have to be considered for a commercial use like this; it may affect access having limited highway frontage.

Evaluation

1) Compatibility with existing facilities: To clear enough space for a garden center, some of the gas collection pipe would have to be buried. Plants whose root systems could penetrate the final cover could not be planted in the landfill itself, but could be maintained in balled or potted forms. Utilities would have to be developed to service the garden center; water and sewer could prove the most difficult to install and could require importation of some additional soil materials. Foundations for building would be quite shallow since the buildings would be small and light duty.

2) Settlement: Since the buildings would be light duty, with minimal foundations, settlement should not affect the foundations. It is still possible that damage may occur to buildings or greenhouses, but not on the scale of the damage to a larger, permanent structure.

3) Operation and maintenance of the site: The garden center should not keep crews from doing on-going O&M work. Additional and more costly maintenance may be created by having gas collection manifolds buried underground.

4) Slope of the site: Not a factor for a garden center.

5) Health and safety concerns: The garden center would be fenced to restrict users' access to landfill facilities.

6) Local zoning and code requirements: Zoning is compatible with this use.

7) Neighborhood enhancement: If the business were well run, it would provide a neat, visually attractive display of greenery to the neighborhood.

8) Neighborhood compatibility: A garden center would fit in well as there are other small commercial enterprises along Pacific Highway South.

9) Cost and funding: Not applicable.

10) Operation and maintenance of the garden center: Not applicable.

11) Landfill gas utilization: If it could be done in a cost-effective manner, the landfill gas could be used to heat the greenhouses or buildings. Initial inquiries into gas utilization at Midway have shown that utilization of this resource may not be economically advantageous.

12) Population served: Not applicable.

13) Community acceptance: This use was rated highest of all commercial uses by the MCAC, and would seem to be a desirable use.

Composting Facility

A composting facility takes organic material such as grass clippings, clean wood, tree branches, etc., and creates a soil enhancer from these materials after the composting process is complete. As recycling becomes more important as a means of waste control, composting is becoming a more widely used means of dealing with parts of the waste stream.

Evaluation

1) Compatibility with existing facilities: The manifolds from the gas control system would have to be either moved or buried over a certain part of the landfill to create enough open space for the composting facility. It would also have to be designed so that it did not affect the existing drainage system.

2) Settlement: This is not likely to be a limiting factor for a composting facility.

3) Operation and maintenance of the site: Additional and more costly maintenance may be created by having gas collection manifolds buried underground.

4) Slope of the site: Not a factor.

5) Health and safety concerns: The facility would have to be fenced to separate it from adjoining uses. Increased truck traffic would require a traffic management plan.

6) Local zoning and code requirements: Zoning is compatible with this use. However, the additional truck traffic would have to be managed by either signalling or a traffic management plan.

7) Neighborhood enhancement: There are a few potential drawbacks to a composting facility in this category. In existing facilities there have been difficulties controlling odors from the decomposing material. It is also possible that rodents might be more prevalent around a composting facility than other potential uses. Drainage would have to be carefully monitored and perhaps recycled, so that water from the composting windrows did not leave the site untreated.

8) Neighborhood compatibility: Since the area contains mixed uses, this would not be incompatible with this area.

9) Cost and funding: Not applicable.

10) Operation and maintenance of the facility: This would have to be done so that potential drawbacks were minimized as much as possible.

11) Landfill gas utilization: A composting facility would not use landfill gas for any foreseeable purpose.

12) Population served: This would provide a regional benefit in the control of solid waste.

13) Community acceptance: This use was ranked as the second highest commercial use by the MCAC with a rating of 42 out of 60. However, it may be possible that many citizens in the area do not want anything perceived as waste being brought back into the area.

Community College Annex

A community College Annex would provide additional classroom space for a local nearby college like Highline Community College. This would have to consist of portable classrooms because permanent buildings do not meet criteria required by settlement and cover integrity.

Evaluation

1) Compatibility with existing facilities: Gas control manifolds would have to be buried underground over a portion of the landfill to provide the space necessary for this use. Access to the portable classrooms and parking for users would have to be provided. These would have to be designed so that the barrier layers of the final cover were not disturbed. Bringing utilities in would require special techniques so the final cover would not be disturbed. Additional soil material may be required for utilities, landscaping, or burying the gas manifold.

2) Settlement: If portable classrooms are used, settlement should not be a problem.

3) Operation and maintenance of the site: This would be more costly because of burying part of the gas control system. Access for repairs and maintenance would be more of a problem.

4) Slope of the site: This should not be a problem.

5) Health and safety considerations: The portion of the site being used would have to be fenced to keep it separate from the rest of the landfill. Additional traffic control may have to be used because of the greater number of people and vehicles.

6) Local zoning and code requirements: Zoning is compatible with this use. Utilities would have to be made available to service the people using the facility -- sewer, water, and power would have to be provided without compromising the final cover. This could require special design or the importation of additional soil materials. Traffic control would have to be improved to handle access from State Route 99.

7) Neighborhood enhancement: The grounds around the portables could be landscaped as long as the plantings did not damage the barrier layers of the final cover. The plantings would probably require using additional soil. Otherwise this use would add little visual appeal to the area.

8) Neighborhood compatibility: Since this area has mixed uses, this use would not be incompatible. Residents in the area would find this a service in providing a facility for further education.

9) Cost and funding: The cost of the facility would be borne by the educational institution.

10) Operation and maintenance of the use: This would be paid for by the institution.

11) Gas utilization: It is possible that the gas could be used for heating purposes if the cost of supplying it to the buildings did not exceed the savings over using another energy source.

12) Population served: This would benefit the Midway region by providing educational opportunities.

13) Community acceptance: The MCAC rated this use quite high. Nearby neighbors would bear the greatest impact because of traffic and noise impacts.

Driving Range

Using part of the landfill site as a driving range would require fencing off a portion of the site, installing lights, water and sewer facilities, and developing parking for users. The open space would be a good place to site such a use; however, the gas control system would have to be buried throughout this area, or access to the area restricted and Seattle landfill staff retrieve balls for a fee.

Evaluation

1) Compatibility with existing facilities: The gas control system would have to be buried or some sort of shielding device created to protect the gas control pipe throughout this area in order to avoid damage from flying golf balls. Depending on the location of the driving range on the site, access would have to be provided through new roads. If the facility were to be used at night, high lights would have to be erected without damage to the cover. Protective nets would need to be installed to keep balls within the facility.

2) Settlement: This may not be a problem for this use because the building(s) used could be quite light duty or portable.

3) Operation and maintenance of the site: O&M would be more difficult because at least some of the gas manifolds would have to be underground.

4) Slope of the site: This should not be a problem for a driving range.

5) Health and safety considerations: The area would have to be fenced off from the rest of the landfill.

6) Local zoning and code requirements: Zoning is compatible with this use. However, installing utilities would have to be done without disturbing the barrier layers of the final cover, possibly by importing additional soil materials. There may need to be improved traffic control at State Route 99 to handle the additional traffic. Parking would need to be provided for the facility.

7) Neighborhood enhancement: The facility would not be unattractive, although the high fencing to contain the golf balls may not appeal to all tastes.

8) Neighborhood compatibility: This would fit in with the varied uses in this area. Nearby residents would be affected by the increase in traffic and noise, and the use of high lights for night-time use.

9) Cost and funding: Since this would be a commercial enterprise, the cost would be borne by the investors.

10) Operation and maintenance of the use: This would be done by the investors.

11) Gas utilization: This use presents no opportunity for gas utilization.

12) Population served: This would be a good recreational use for golfers in the general area.

13) Community acceptance: The MCAC rated this moderate to high in their evaluation.

Golf Course

This use is very similar to the driving range. It would require more land, perhaps consuming the entire site, than the driving range and would perhaps be used more heavily. Since a golf course could sprawl over the entire site, the whole gas control system would have to be buried beneath the ground surface, a very major undertaking. The clubhouse/restaurant would have to be located on the non-fill area nearest to State Route 99. This was not as highly preferred as the driving range by the MCAC by a significant margin. This may be because it would attract more people to the area, and have a greater impact on nearby homes.

Recycling Center

A recycling center would be a facility where material would be gathered, stored, and distributed for reuse. It would involve truck delivery of recyclables for sorting and distribution. Buildings would be required for storage and sorting. This use will not be evaluated further because the buildings would not be appropriate for the site with its gas control apparatus, limitations imposed by the final cover, and settlement affecting the buildings. Members of the MCAC objected to the noise and truck traffic involved in this use. They are opposed to refuse being trucked into the area; they feel they have seen enough of this in the past.

Park and Ride Lot

This use would set aside part of the site for transit users to leave their cars while they traveled the rest of their way using transit.

Evaluation

1) Compatibility with existing facilities: The gas control piping and apparatus would have to be buried and secured over the area of the parking lot. Some of the piping could perhaps be buried in vaults in landscaping areas around the perimeter. Access would have to be provided from State Route 99. Having a large number of cars parked on the landfill site could possibly cause run-off from the parking area to become contaminated with oil and other contaminants that come from cars. This would have to be controlled so that this did not enter the landfill detention pond, or monitoring would have to be planned to make sure that surface water run-off was in compliance for release from the pond.

2) Settlement: Since the parking lot would have to be paved, settlement could be a problem and cause increased maintenance.

3) Operation and maintenance of the site: Operation and maintenance of the site would be more difficult because the gas manifolds would be buried.

4) Slope of the site: Since a park and ride lot would not be affected by a slight slope, this would not be a factor.

5) Health and safety considerations: The lot would have to be fenced off from the rest of the site. There are perceived problems with vandalism at park and ride lots, and this would have to be guarded against. Since the site is some distance from State Route 99, there may be a need for lighting or increased police presence around the lot and its access road.

6) Local zoning and code requirements: Zoning is compatible with this use. There may be a need for additional traffic control at the entrance/exit of the lot, especially during peak use hours.

7) Neighborhood enhancement: This would not necessarily be an aesthetically pleasing use of the area, and some nearby residents may find it objectionable. Additional effort and expense would have to be taken to make it more attractive.

8) Neighborhood compatibility: This use is compatible with the industrial and commercial use of State Route 99. However, there are residences to the north and south that are in view of the site, and this use is not as compatible with nearby residential use.

9) Cost and funding: This would be paid for by the transit system using it as a collection point.

10) Operation and maintenance of the use itself: This would also be paid for by the transit system using the property. This cost may be higher than that at other such lots because of landfill settlement.

11) Gas utilization: A park and ride lot would have no use for the methane generated at the landfill.

12) Population served: This would provide parking for area residents finding this a convenient location to use transit. There are other park and ride lots located within a mile of the landfill location. However, Metro, the transit agency, says they are at maximum utilization.

13) Community acceptance: This use was rated quite low by the MCAC, and some members of the committee were strongly opposed to this use.

Trailer Court

This use would require setting aside space for a certain number of trailers to be used as residences. This would involve putting a major portion of the gas control system underground. Residents would not have full use of their properties for planting or gardening because there could be no damage allowed to the final cover. Putting in utilities for this number of residences would be a major obstacle. The MCAC rated this use lowest of all considered uses. For these reasons, this use will not be considered further.

CONCLUSION

This effort evaluated the preliminary future site uses identified at this time, and a final site use evaluation would be necessary before any use was selected. Over the course of the next twenty years many things could change: selection criteria, technology, community preferences. Seattle is committed to the operation and maintenance of the Midway site in an environmentally safe and responsible manner and to remaining responsive to the desires of the Midway community. Any updated study regarding potential uses would also involve the community's input and feedback.

MIDWAY LANDFILL
COVER SYSTEM PROJECT

DESIGN MEMORANDUM

FUTURE LANDSCAPE IMPROVEMENTS
PLANTING METHODS AND RECOMMENDATIONS

Osborn Pacific Group Inc.
July 15, 1991

DESIGN MEMORANDUM

FUTURE LANDSCAPE IMPROVEMENTS
PLANTING METHODS AND RECOMMENDATIONS

The primary aim of planting design at the Midway Landfill will be to use plants to create spaces, separate uses, and provide habitat. Basic to this is a knowledge of plant characteristics, what functional problems they solve and how effectively they solve them individually or in a specific organizational framework.

Because of the significant limitations placed on revegetation at the landfill, it will be necessary to not only analyze the functional uses plants play in this environment, but in this case how that particular functional use can be successfully implemented in light of the severe growth restrictions identified throughout this report.

The following are brief discussions on the functional uses landscaping can provide at the Midway Landfill. Each of these functional uses should be evaluated in terms of how they will relate to, modify or influence each of the proposed land uses selected to be further investigated as a result of this study. Plant materials appropriate to accomplishing the goals of each of these functional uses are listed in the succeeding section. This matrix of plant materials identifies both major functional and growth characteristics of each plant. All materials evaluated have been selected for their hardiness and adaptability. The planting methods appropriate for the Midway landfill site are discussed following the plant selection matrix.

Functional Uses of Plants

Plants are among the most complex components that a designer uses -- complex because they are living, growing and changing with each season. Traditionally, their primary use has focused on their aesthetic qualities and beauty. However, in an environment which is rapidly becoming urbanized and denaturized, plants now assume, by design, functional uses. For example, when particular plant species are grouped together in a specific organizational pattern, it is possible to categorize planting patterns into functional uses; that is, architectural, engineering, aesthetic, and habitat restoration.

Architectural Uses

Space Articulation

Plants can be massed to form walls, canopies or floors in the landscape. They can be used to articulate, define, enclose or delimit exterior space either by themselves or in conjunction with

other landscape architectural components. Because plants can control both the size and quality of exterior space, they can control, to a large extent, human perception of the space.

A key use of space articulation at the landfill will be through scale modulation -- the altering of the apparent or perceived scale through the introduction of plants. The texture, size, form, and color of plants can be used to vary the apparent scale. For example, plants can be used to reduce or enlarge the apparent scale. Small-scale plants can cause the observer to feel taller. Extremely large-scale trees can cause the observer to feel smaller. Plants can push a view into the distance, or pull it close to the observer.

Screening

Screening is visually blocking out that which is unsightly with something more harmonious or at least less offensive. It is a means of visual control through directing views. Although plants are growing, changing elements, and as such are less dependable and predictable in their density or ultimate form than are fences, walls, or architecture; they do have the benefit of their natural appearance and they have rich inherent design characteristics because of their diverse form, texture, and color. When plants are used for screening, evaluations must be made such as:

- What needs to be screened?
- From which direction is it needed?
- How much or how dense a screen?
- Is the viewer stationary or mobile?
- What is the viewer's angle of approach to the unpleasant view?
- At what season is it most unsightly?
- Can the viewer be directed to an alternative view in addition to or instead of screening?

Responses to these questions provide criteria for the designer to select the type, height, width, and extent of planting necessary to do an efficient job of screening.

Progressive Realization

There are limitless possibilities in the combination of plant forms for progressive realization -- i. e., that a view can be enhanced if it is seen through an opening. If a view or an object in the landscape is slightly, rather than fully revealed to the viewer, the experience while moving through the landscape is enriched.

To effectively create a design using plants for progressive realization, the plants must be used so that they are subconsciously perceived by the viewer as a screen, a foreground, a background, or a frame. Most of the landscape is perceived while moving, either walking or riding; and the speed of movement must be considered in using plants for progressive realization.

Human Activities

The primary goals of site design and the use of plant material are to blend the site uses to the landscape and create both a separation of uses and transitions between activities. Plant materials are used to create open areas for active recreation, separation of parking and circulation corridors, framing and enhancing buildings, and the creation of naturalized areas for passive recreation. The planting design for the project area and the uses selected must be developed simultaneously to effectively support and complement the landscape and the user.

Engineering Uses

Erosion Control

Soil erosion is the loss of soil -- usually the productive top 7 to 8 inches -- by action of wind or water, due to lack of proper ground, soil, or earth cover. The degree of soil erosion is determined by the site's exposure to wind and water influences, the climate, the soil character, and the length and degree of slope of the terrain.

Plants deter soil erosion by the cover they provide and the spread of their rooting systems. Four parts of plants which control wind erosion are: dense leaves or needles that create an effective barrier to air movement through plants; dense branching that controls and slows wind close to the ground; multiple stems and rough bark that decrease wind velocity as it passes through them; and fibrous roots that grow close to the surface and effectively hold surface soil in place. The best plants for soil erosion control are ground covers or those which are densely branched to the ground, and those having a fibrous, shallow root system.

Plants can be used to control and prevent water-caused soil erosion in at least three ways. Leaves and branches form canopies or blankets interrupting raindrops, thus reducing splash erosion. Roots form fibrous masses within the soil, holding it in place. Leaves and other dead parts of plants on the soil surface increase the organic material in the soil, loosening it and increasing its water absorption rate.

Traffic Control

Plants may be used to assist in controlling bicycles, automobiles, motorcycles, pedestrians, and animals -- while adding to the visual quality of the environment. Before considering plants to control traffic, the designer must decide how much control is needed. It may be that lawn, ground cover, a low hedge, a high hedge, large plants, or even a combination of plants is necessary. The characteristic of the plant variety, the ultimate height of the plant, spacing or planting density, and eventual desired width of plantings are criteria to be evaluated for determining the effectiveness and efficiency of plants being used to control each type of traffic use.

Aesthetic Uses

Form, color, texture, and placement combine to create visual relief in a manmade environment. Visually, the plant is perceived in two ways: (1) When it is an object to be seen and to be noticed -- when the plant or its parts are what is important or of interest; and (2) When a plant exists to enframe or outline a view or activity or to serve as a backdrop.

Aesthetically, a plant may appear as a *sculptural element*, whereby the viewer particularly notices its shape, silhouette, or mass.

The mere *naturalness* of a plant may be enough reason to use it aesthetically. As more and more manmade elements comprise the cultural milieu, the introduction of a natural element breaks the harshness, coldness, and in the case of Midway Landfill -- the starkness of the environment.

The vast palette of *color* available in plants is a basic aesthetic consideration in their use. The various parts of plants have a wide selection of hues, intensities, and values. Trunks, roots, branches, twigs, and leaves all provide color in plants.

The use of color is tied to dynamic emphasis, accent, decoration, attraction, and organization. The changing colors of plants assume great importance. Daily, plants are lighted sequentially by the sun and the moon. Seasonally, they undergo cycles of winter, spring, summer and autumn. Plants, too, go through a cycle of growth, death, and decay. How plants are perceived is altered by light patterns and moisture. The plant interacting with wind gives added movement, life and character to the scene in which it is placed.

Habitat Restoration

Restoration of environments damaged or disturbed by human activity is a primary use of plant materials. Landscapes which have been stripped of natural cover can be replanted with a successional variety of materials to generate a vegetative cover. The new growth of trees, shrubs and grasses invites birds and animals to rehabitat the areas.

Naturalized planting design is the key for accellerating the healing process for damaged environments. Plant materials restore needed nutrients to the soil, creating over time a layer of healthy organic soils. Plants give shelter and food for pioneer communities of insects, birds and mammals, which in turn contribute to the development of the habitat.

Knowledge of plant and animal relationships can help restore species habitats. Plant materials are selected and arranged to provide stands for nesting, feeding, and cover. Habitat restoration is not accomplished overnight. Restored habitats are ecologically unstable and can easily revert to their former condition or decline as a result of the invasion of exotic species.

Plant Selection Matrix

The transitional Midway environment is a restrictive microclimate for plant materials. The actual materials chosen for uses on the site, their locations and their massings will depend on activities selected for the future Midway development. The matrix identifies the major functional goals for each plant species.

All of the plant materials are a recommended selection of species that are hardy and have low water requirements. Many are native species. A limited number of larger species have been included to create an over-head canopy and visual diversity. However, the larger materials will require special planting and design considerations, as discussed in the Planting Methods and Recommendations section.

PLANT NAME	FUNCTIONAL GOAL						CHARACTERISTICS					REMARKS
BOTANICAL NAME/ COMMON NAME	BARRIER/SCREENING	FOCUS/ACCENT	ENHANCEMENT	SPACE SEPARATION	EROSION CONTROL	HABITAT RESTOR.	HEIGHT	EVERGREEN	FLOWERING	FALL COLOR	FRUIT/BERRIES	
TREES												
ACER CIRCINATUM/		X	X				25-30'			X		
VINE MAPLE												
ACER GINNALA/		X	X			X	to 20'			X		
AMUR MAPLE												
AMELANCHIER LAEVIS/		X	X			X	30-35'		X	X	X	NON-AGGRESSIVE ROOT SYSTEM
SERVICE BERRY												
CORYLUS CORNUTA CALIFORNICA/		X	X	X		X	8-12'			X	X	NATIVE, AVERAGE WATER
WESTERN HAZELNUT												
MALUS SPP./		X	X			X	20'		X		X	
FLOWERING CRABAPPLE												
PICEA SITCHENSIS/	X		X	X	X	X	to 80'	X				TALL PYRAMIDAL FORM
SITKA SPRUCE												
PINUS CONTORTA/	X			X	X	X	20-35'	X				VERY HARDY
SHORE PINE												
PINUS MONTICOLA/	X			X	X	X	to 60'	X				VERY HARDY
WESTERN WHITE PINE												
PINUS NIGRA/	X			X	X	X	to 40'	X				VERY HARDY
AUSTRIAN PINE												
POPULUS TREMULOIDES/		X	X				to 60'			X		LEAVES FLUTTER IN SLIGHTEST WIND
QUAKING ASPEN												
PRUNUS VIRGINIANA/		X	X			X	20-25'		X	X		DROUGHT AND HEAT TOLERANT
CHOKECHERRY												
QUERCUS GARRYANA/		X	X		X	X	to 80'			X		NON-AGGRESSIVE ROOT SYSTEM
GARRY OAK												
RHUS GLABRA/		X			X		10-15'			X		DROUGHT TOLERANT, TAKES MOST SOILS
SMOOTH SUMAC												
RHUS TYPHINA/		X			X		20-25'			X		DROUGHT TOLERANT, TAKES MOST SOILS
STAGHORN SUMAC												

PLANT NAME	FUNCTIONAL GOAL						CHARACTERISTICS					REMARKS
BOTANICAL NAME/ COMMON NAME	BARRIER/SCREENING	FOCUS/ACCENT	ENHANCEMENT	SPACE SEPARATION	EROSION CONTROL	HABITAT RESTOR.	HEIGHT	EVERGREEN	FLOWERING	FALL COLOR	FRUIT/BERRIES	
SHRUBS												
ARBUTUS UNEDO/	X				X		8-10'	X			X	DROUGHT TOLERANT
STRAWBERRY TREE												
ARONIA ARBUTIFOLIA/					X	X	6-10'			X	X	TOLERATES POOR SOIL
RED CHOKEBERRY												
CEANOTHUS/		X				X	varies	X	X			DROUGHT TOLERANT
WILD LILAC												
CHAENOMELES/	X	X	X			X	5-10'		X	X	X	VERY HARDY
FLOWERING QUINCE												
CISTUS HYBRIDUS/	X				X		5'	X	X			TOLERATES POOR SOIL, DROUGHT RESIST.
ROCKROSE												
COTONEASTER PARNEYI/	X		X		X	X	8-10'	X			X	
PARNEY COTONEASTER												
CYTISUS SPP./		X					5-6'		X			DROUGHT TOLERANT
BROOM												
GARRYA ELLIPTICA/	X	X				X	15'	X	X		X	
COAST SILKTASSEL												
JUNIPERUS SPP./	X				X		varies	X			X	TOLERATES POOR SOIL, DROUGHT RESIST.
JUNIPER												
MAHONIA AQUIFOLIUM/	X					X	3-6'	X			X	DROUGHT TOLERANT
OREGON GRAPE												
MYRICA CALIFORNICA/	X		X			X	10-15'	X				DROUGHT TOLERANT
MYRICA												
OSMANTHUS DELAVAYI/		X					4-6'	X	X			DROUGHT TOLERANT
DELAVAYI OSMANTHUS												
PHYSOCARPUS CAPITATUS/					X		5-8'		X			VERY HARDY
NINEBARK												
PINUS MUGO/					X		5'	X				DROUGHT TOLERANT
MUGO PINE												

PLANT NAME	FUNCTIONAL GOAL						CHARACTERISTICS					REMARKS
BOTANICAL NAME/ COMMON NAME	BARRIER/SCREENING	FOCUS/ACCENT	ENHANCEMENT	SPACE SEPARATION	EROSION CONTROL	HABITAT RESTOR.	HEIGHT	EVERGREEN	FLOWERING	FALL COLOR	FRUIT/BERRIES	
SHRUBS (cont.)												
POTENTILLA FRUITICOSA/		X			X		3'		X			TOLERATES POOR SOIL
CINQUEFOIL												
RIBES AUREUM/		X	X			X	8-10'		X	X		DROUGHT TOLERANT
GOLDEN CURRANT												
ROSA RUGOSA/	X	X			X	X	3-8'		X	X	X	VERY HARDY
RAMANAS ROSE												
SAMBUCUS CAERULEA/	X		X			X	30-40'				X	
BLUE ELDERBERRY												
SAMBUCUS RACEMOSA/	X			X		X	8-10'				X	
RED ELDERBERRY												
SPIREA SPP./		X	X			X	4-6'		X	X		TOLERATES POOR SOIL
SPIREA												
VACCINUM OVATUM/		X				X	2-3'	X	X		X	
EVERGREEN HUCKLEBERRY												

PLANT NAME	FUNCTIONAL GOAL						CHARACTERISTICS					REMARKS
BOTANICAL NAME/ COMMON NAME	BARRIER/SCREENING	FOCUS/ACCENT	ENHANCEMENT	SPACE SEPARATION	EROSION CONTROL	HABITAT RESTOR.	HEIGHT	EVERGREEN	FLOWERING	FALL COLOR	FRUIT/BERRIES	
GROUNDCOVERS												
JUNIPERUS SPP.					X		12"	X				DROUGHT TOLERANT
JUNIPER												
ARCTOSTAPHYLOS UVA-URSI			X		X		10"	X	X		X	SPREADING
KINNIKINNICK												
HYPERICUM CALYCINUM		X	X		X		12"	X	X			DENSE, TOLERATES POOR SOIL
ST. JOHNSWORK												
CEANOTHUS GLORIOSUS					X		12-18"	X	X			
POINT REYES CEANOTHUS												
HEDERA HELIX			X		X		12"	X				SPREADING
ENGLISH IVY												
VACCINIUM VITIS-IDAEA		X	X		X		12"	X	X		X	
FOXBERRY												
PERENNIAL GRASSES												
MEADOW GRASS			X		X	X	to 3'					DROUGHT TOLERANT
ATHLETIC FIELD GRASS			X		X		2-3"	X				ALLOWS RECREATIONAL USES
WILDFLOWER GRASS MIX		X	X		X	X	to 3'		X			DROUGHT TOLERANT
PARK LAWN			X		X		3-4"	X				ALLOWS RECREATIONAL USES

Planting Methods and Recommendations

To this point, we have discussed the function of plants for enhancing potential future uses at the Midway landfill site, and the selection of plant materials whose growth requirements and habits are possibly conducive to the site conditions. The landfill cover system is comprised of specific soil layers, synthetic membrane, filtering fabrics, drainage systems, and a complex network of piping for collecting hazardous fumes. Installation of plant materials within this cover system requires an extensive set of parameters to ensure the design integrity of the cover remains intact for the next 30 years.

Ideally, a selection of plants that grows naturally in soil one feet deep, requires minimal watering and provides diversity in size, shape and color would be perfect. Unfortunately, planting requirements for the majority of plants, especially trees and shrubs, exceed the minimum conditions provided by the landfill cover. Several methods for enhancing and creating planting opportunities are described below.

Soil Berming

Increasing the planting depth to four feet or more would greatly enhance the variety of materials that can be grown at the Midway site. Spread over large areas and gradually transitioned from existing grades to maximum soil depths (minimum 100' transition in all directions), this additional soil would distribute the soil weight gradually and uniformly to minimize uneven settling. Extra soil depth can also mean healthier root systems which strengthens plant stability. Large massings of shrubs and trees could then be used to create various spatial definitions and patterns. Existing drainage patterns within the site would remain, for the most part, intact. One site design option may include using these drainage patterns in developing the planting layouts.

Root Control

Of course, regardless of the depth, root habits will vary depending on plant species, soil types, and water availability. Root control devices such as impenetrable fabrics, containers or growth deterrents would further prevent water-seeking roots from entering and damaging the existing delicate drainage network. Several products on the market today offer barrier systems which combine fabric with time-released herbicides to retard root growth or deflect roots from deeper penetration without harming the vegetation or damaging the landfill cover system. Used in conjunction with the supplemental soil layer, this would enable trees and shrubs to mature and become established by the time the landfill is finally opened to the public.

Another method for root control is landscape containers fabricated from steel or other non-biodegradable materials. Although the major drawback of this method is cost, containerized

plant materials would be appropriate and desirable in areas near entry ways and places where a single shrub or tree would be used as an accent. Installation may be above-ground or partially in the ground with the remainder of the container exposed.

Water Availability

As mentioned earlier, root growth habits will vary depending on water availability. Inadequate watering can cause plants to die or, depending on plant species, to become very aggressive in search for water. Carefully designed irrigation systems would deliver adequate water to the plants at scheduled intervals and at desired precipitation rates to minimize excess surface runoff. Even more efficient are drip irrigation systems which allow plants to be fed water directly at the root zone.

For the Midway Landfill site, the recommended irrigation system would include both types of irrigation: Sprinklers to maximize coverage for expansive groundcover and turf areas; and drip irrigation to provide adequate and uniform watering to the larger trees and shrubs.

An organic mulch top dressing is recommended on all planting areas to enhance the water retention properties of the soil and to supplement the soil nutrients. Although bark chips are the most commonly used mulch, this would be an excellent opportunity for the City of Seattle to promote and encourage the use of recycled products, such as Groco (sludge byproduct) and Cedar Grove Compost (yard waste byproduct).

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